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AUTHORS' REPLY

To discussion of the paper 'Multi-criteria optimal structural design under uncertainty'

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The authors thank the discussers for their interest in the authors' paper and for drawing attention to the earlier work published by the discussers and their colleagues which is similar in spirit to the optimal design philosophy presented in our paper.

The discussers approach using dissatisfaction functions is close to our approach using preference functions and their aggregation in multi-criteria optimal design. Their minimization of a global objective function which is the maximum of the dissatisfaction function values for each criterion is one we also explored in the setting of preference functions where it becomes a max–min strategy. As discussed in our paper, this conservative strategy satisfies the preference aggregation axioms but because it focuses on improving the worst aspect of the design, it does not allow as free a trade-off as in the multiplicative trade-off strategy that we favour. Another potential disadvantage of the conservative strategy is that it leads to a non-smooth objective as a function of the design parameters which has razor-back ridges. Depending on the choice of optimization algorithm, this may cause difficulties in finding the optimal design.

The authors do not agree with the discussers comments that the use of preference functions makes it 'difficult to indicate the level of violation of constraints and the level of satisfaction of objectives with the present preference functions'. For a given design, the preference function value for each design criterion (constraint or objective) gives directly the degree of satisfaction of that criterion by the design, as described in our paper. This is equivalent to the use of dissatisfaction functions.

Our formulation applies to either linear or non-linear inelastic structural models. For simplicity, we have chosen in the paper to illustrate the reliability-based multi-criteria optimal design concepts with linear models. However, we have also worked on efficient methods for addressing important computational issues encountered when calculating the structural reliability based on non-linear inelastic models [1, 2].

REFERENCES

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